



Action on climate change mitigation in German and Chinese cities – A search for emerging patterns of accountability

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ABSTRACT

The article explores emerging patterns of accountability in German and Chinese low-carbon urban development. It draws on multi-level vertical and horizontal governance perspectives and identifies the current status of institutional innovations in order to steer action on climate change mitigation in urban environments. To underpin the relevance of the research, it is shown that factual responsibilities as well as political mandates, require enhanced and accountable action on climate change mitigation at city level. Drawing on political documents, scientific literature, as well as institutional arrangements developed under the international regime of climate governance, four components of accountable governance are identified and applied to the case studies of Germany and China, with a focus on the cities of Hamburg and Shenzhen.

1. Introduction

Global warming is one of the most pressing environmental and societal challenges of our times. Globally, scientists and politicians agree that meeting these challenges requires great transformation processes compared to business as usual (Schellnhuber et al., 2011). Bridging the disciplines of legal sciences and urban studies, this article explores accountable modes of governance of cities' carbon footprints in Germany and China, in order to activate the transformative forces within cities. The research builds on Ostrom's assumption that complex societal problems with unknown solutions are best addressed by a variety of actors and overlapping policies at local, national, and international levels (Ostrom, 2012), and aims to contribute to the growing field of studies concerned with polycentric climate governance (Jordan et al., 2015; Chan, Choy, & Yung, 2013). Empirical research in Europe demonstrated a wide variety of target setting and strategic climate actions at city level (Heidrich et al., 2016; Reckien et al., 2014). However, it also identified a lack of mechanisms that ensure that targets are met (Bulkeley et al., 2011; Sippel, 2011) and – in terms of Bache et al. – an “accountability vacuum within an increasingly complex architecture of multi-level governance” (Bache, Bartle, Flinders, & Marsden, 2015).

The present research conceptualizes cities as actors in vertical and horizontal, legally-binding, politically mandated, or voluntary networks and hierarchies of climate governance. It aims to trace the current state of accountability requirements in such networks and hierarchies in the jurisdictions of China and Germany as well as cities' responses to and dealing with such requirements. In order to establish the relevance of the research, the article, firstly, argues that factual

responsibilities as well as political mandates require enhanced and accountable climate change mitigation action at city level (2). Secondly, drawing on political documents, scientific literature and institutional arrangements developed under the international regime of climate governance, four components of accountable governance are identified to serve as a basis for the case studies (3). Centrally, the article compares the current institutions for strategically steering action on climate change mitigation in Chinese and German cities and identifies patterns of accountability (4). Finally, conclusions are drawn and a need for further research identified (5).

2. Factual and political responsibilities

Urban infrastructures and lifestyles leave global footprints (Brenner & Schmid, 2011; Rees & Wackernagel, 1996). In 2005, approximately 75% of global energy flows were consumed in cities (Swilling, Robinson, Marvin, & Hodson, 2013). Nowadays, about half of the world's population lives in cities and this number is expected to rise to 66% by 2050 (UN DESA, 2015). With a growing urban population, the share of energy consumption in cities will continue to rise. The research is built on the presumption that cities are not only part of the problem but also part of the solution (Creutzig, Baiocchi, Bierkandt, Pichler, & Seto, 2015; Kennedy et al., 2012, 2014).

The crucial role of cities for global sustainability is increasingly recognized by states and fully embraced in key documents of the global governance agenda such as the 2030 Agenda for Sustainable Development (SDG 11) and the 2016 ‘New Urban Agenda’ (see e.g. paras 9 and 15c) both adopted by Germany as well as China. Cities are

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<https://doi.org/10.1016/j.habitatint.2018.03.008>

not assigned rights and obligations under the Paris Agreement. However, states recognize “the importance of the engagements of all levels of government” in the preamble.

In addition to these international political mandates adopted by states and the respective national urban policies, cities themselves are increasingly engaging in international networks, developing voluntary pledges to reduce greenhouse gas emissions and working towards greater urban sustainability. For example, ICLEI – Local Governments for Sustainability, C40 Cities Climate Leadership Group and the Global Covenant of Mayors for Climate and Energy are three global networks which support cities in taking measurable action on climate change.

3. Conceptual approaches to accountability

3.1. Political commitments

Under SDG 16, states signed up to “[...] [b]uild effective, accountable and inclusive institutions at all levels.” According to the respective sub-targets, they agreed to “[p]romote the rule of law at the national and international levels [...]” (16.3), “develop effective, accountable and transparent institutions at all levels” (16.6), and “ensure responsive, inclusive, participatory and representative decision-making at all levels” (16.7). Similarly, in the New Urban Agenda, states underlined the political goal of accountable governance in various sections. For example, states agreed to “encourage appropriate regulatory frameworks and support to local governments in partnering with communities, civil society and the private sector to develop and manage basic services and infrastructure, ensuring that the public interest is preserved and concise goals, responsibilities and accountability mechanisms are clearly defined” (para. 91).

In addition to these state-level commitments on accountable local governance, cities that joined the Global Covenant of Mayors for Climate and Energy, according to the Charter, agreed to: “develop the institutional political processes that make effective action possible by embedding climate action into municipal processes, structures and policies; move towards transparent standard procedures and methodologies to increase international accountability [...]” and “commit to adopting a comprehensive plan, to be reviewed and monitored, to meet the commitments made [...]”.

3.2. Scholarly reception

None of the political documents cited above defines the term “accountability”. According to Merriam Webster’s dictionary, accountability is defined as “the quality or state of being accountable; especially: an obligation or willingness to accept responsibility or to account for one’s actions” (Merriam Webster, 2016). Much of the scientific literature discusses accountability in the context of the exercise of state authority and the principal-agent paradigm. This builds on the presumption that the exercise and delegation of power should be safeguarded by mechanisms of accountability. For example, Priest and Stanbury, developed an accountability framework consisting of six main elements within the principal-agent paradigm (Stanbury, 2003). This “accountability loop” extends from the delegation of authority by the principal to the agent (first element), provision of instructions (second element), specification of criteria to assess the performance of the agent (third element), information about the agent’s actions (fourth element), assessment of performance (fifth element) to rewarding or sanctioning by the principal depending on the agent’s performance (sixth element). According to Nicolaides, Geveke, and Den Teuling (2003), accountability is strengthened, when the agent is required to explain and justify his actions to those who have the necessary knowledge to understand and evaluate those actions. Effective delegation requires both, conferring decision-making discretion on the agent, as well as effective accountability mechanisms to prohibit arbitrary actions by the agent. Cohen and Sabel (2004, p. 771) name transparency, reason-giving, and

the standing of those affected as three essential components of accountability in their research on global democracy.

According to Grant and Keohane accountability, requires that “some actors have the right to hold other actors to a set of standards, to judge whether they have fulfilled their responsibilities in light of those standards, and to impose sanctions if they determine that those responsibilities have not been met” (Grant & Keohane, 2005). Chan and Pattberg define accountability more broadly as a “more or less coherent set of rules and procedures, delineating who takes part in decision-making, who holds whom responsible for what kind of actions, and by which means” (Chan & Pattberg, 2008). In a recent publication, Gordon (2016) further elaborated on accountability in networked urban climate governance and discussed three distinct politics of accountability. Developing a research framework for accountability and legitimacy in earth system governance, Biermann and Gupta (2011) identified four essential elements of accountability: (1) a normative element defined as a certain standard of behaviour, (2) a relational element linking principal and agent, (3) a decision element in the form of a judgment about whether the standard of behaviour has been met, and (4) a behavioural element that allows deviant behaviour to be sanctioned.

3.3. International climate regime

Beginning with the 1992 United Nations Framework Convention on Climate Change (UNFCCC) States that are Parties to agreements under the climate regime, including Germany and China, put much emphasis on establishing procedures and institutions that ensure accountable climate mitigation and adaptation action. Now that the top-down approach of the Kyoto Protocol has been turned into a bottom-up approach under the Paris Agreement in order to enable global commitments, accountability remains crucial and arguably becomes an even bigger challenge.

In order to reach the 2 °C goal of the Paris Agreement, Parties agreed to undertake and communicate “nationally determined contributions” (NDCs) (Art. 3 PA). Such NDCs do not follow a predefined form, unlike the percentage approach applied under the Kyoto Protocol. Parties are generally free to compose their NDCs. They agreed to provide the information necessary for clarity, transparency and understanding in accordance with decision 1/CP.21 (Art. 4 para. 8 PA). NDCs are recorded in a public registry maintained by the secretariat (Art. 4 para. 12 PA). Parties are required to account for their NDCs “promoting” “environmental integrity, transparency, accuracy, completeness, comparability and consistency, and ensure the avoidance of double counting, in accordance with guidance adopted by the COP/MOP” (Art. 4 para 13 PA). In such accounting Parties shall consider existing methods and guidance under the UNFCCC (Art. 4 para. 14 PA). At the heart of institutional arrangements ensuring accountable mitigation action under the Paris Agreement are the “transparency framework” (Art. 13 PA) and the “global stocktake” (Art. 14 PA).

The Marrakech Partnership for Global Climate Action (MP) adopted by Parties to the PA at COP 22, aims to catalyse and support climate action by Parties and non-Party stakeholders in the period from 2017 to 2020 (MP, p. 1). Inter alia, it aims to track the progress of non-Party stakeholders via the UNFCCC Non-State Actor Zone for Climate Action (NAZCA) platform and report achievements and options for enhanced action to the COP (MP, p. 3). Non-Party stakeholders who want to participate in the Partnership accept two main duties ensuring the accountability of their contributions. On the one hand, they agree that their commitments are recorded on NAZCA, and on the other hand they agree to regularly provide information on the status of implementation and progress towards those commitments (MP, p. 4).

3.4. Identified components of accountability

Drawing on the political mandates, scientific literature, as well as arrangements under the international climate regime explored above,

the research identifies four key pillars of accountable climate change mitigation action: responsibility, transparency, assessment, and participation. Those pillars will serve as a basis for the following search for emerging patterns of accountability in action on climate change mitigation by German and Chinese cities and their respective institutions.

Responsibility is a key component of accountability as defined under the principal-agent paradigm, including Grant and Keohane (2005), as well as under broader concepts such as that developed by Chan and Pattberg (2008). In addition, the international climate regime establishes and connects a web of bodies with carefully assigned and balanced responsibilities. It also defines a broad array of responsibilities for its Parties, ranging from soft to hard. Defining responsibilities within a governance network includes outlining who is responsible to whom, for what kinds of actions (e.g. climate change mitigation efforts), by which means (e.g. via monitoring, reporting, disclosing, responding, or submitting to compliance control), and in which forms (varying from soft to hard, e.g. purely voluntary, intended, or mandatory).

Transparency is a second pillar of accountability. For example, the flow of information from the agent to the principal and vice versa is relevant in all definitions of accountability outlined above as well as being key to the procedures established under the international climate regime. Establishing the transparency of a governance network encompasses defining who needs to communicate to whom, what kind of information (e.g. GHG emission inventories, strategies, policies and measures, or costs) in which form (e.g. publicly available or disclosed only to certain actors).

The third pillar of accountability as identified in scientific literature as well as in the international climate regime is assessment. Assessment includes collection, measurement, verification and evaluation of data towards an agreed goal. It encompasses the development, selection and application of assessment methodologies. A transparent assessment requires that the sources of data and value judgements underlying the choices of certain methodologies and evaluation schemes are clearly communicated.

Finally, participation is the fourth pillar of accountability. Scientific literature as well as the international climate regime highlight that accountable governance requires the involvement of the principal (e.g. the people), especially those affected by a policy, and – more generally – transparency as to who takes part in decision-making. There are different forms of participation, ranging from direct to indirect. Furthermore, participation differs depending on the stage in the policy cycle. As the international climate regime shows, different actors participate in varying forms at the stages of goal setting, choice of instruments, implementation, information and evaluation.

4. Case studies – Germany and China

4.1. Cities' responsibility and scope for action in Germany

Germany is a federal country with formal legislative power divided between the national government and sixteen federal states, including three city-states (Berlin, Bremen and Hamburg). Article 28 section 2 of the German constitution ("Grundgesetz") confers the right to local self-government on German municipalities ("Recht der kommunalen Selbstverwaltung"). It empowers local governments – cities and other municipalities – to regulate and manage local affairs under their own responsibility. This includes the power to enact – within the limits of law – municipal ordinances and to raise and spend local taxes.

There is no legal duty on municipalities in Germany to engage in actions to mitigate climate change. The NDC communicated for the European Union, including Germany, is only broadly formulated: "The EU and its Member States are committed to a binding target of at least a 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990, to be fulfilled jointly [...]." On November 16th, 2016, the German cabinet adopted the Climate Action Plan 2050 (CAP) as the

key policy paper guiding Germany to become essentially GHG-neutral by 2050 (CAP at 2.4). The plan sets out precise emission reduction targets for different sectors of industry to be reached by 2030 (CAP at 5). It generally also refers to the importance of enhanced mitigation action at all levels, including the local level (CAP at 4.3). However, a specific, e.g. quantified, responsibility of cities is not part of the German CAP.

German climate policies with regard to municipalities and cities are currently limited to financial incentive programmes. At the heart of these programmes is the National Climate Initiative (Nationale Klimaschutzinitiative) which offers two key instruments directed at municipal climate mitigation action: (1) the "Municipality Guideline" (Kommunalrichtlinie) which – inter alia – financially supports municipalities in developing integrated climate action plans and (2) the "Master Plan Guideline" (Masterplan-Richtlinie) which financially supports municipalities who committed themselves to reducing their GHG emissions by 95% by 2050 and their final energy by 50% compared to 1990 levels. So far, 41 German municipalities have signed up to these ambitious reduction targets, including some "bigger" cities such as Frankfurt am Main and Stuttgart. Important voluntary bottom-up city and regional initiatives working towards becoming carbon neutral or generating 100% renewable energy supply are the Climate Alliance Network (Europe), the 100% Renewables Regions ("100%e Regionen", Germany), and the 100% RES Communities (Europe).

Thus, within their scope of local self-governance as provided for by article 28 section 2 of the German constitution, municipalities are free to plan and implement actions on climate change mitigation. To strategically steer such efforts, many German municipalities enacted climate action plans (Kahl & Schmidtchen, 2013, p. 342). The one developed by the city-state of Hamburg will be presented below.

4.2. Cities' responsibility and scope for action in China

In contrast to Germany, the People's Republic of China is a unitary state with one central state government. The state structure below the central level divides into provinces, districts, counties, municipal districts, and villages (Noesselt, 2016, p. 78). Directly subordinated to the central government are 33 provincial governments, comprising 22 provinces, five autonomous regions, four direct-controlled municipalities (Beijing, Tianjin, Shanghai, and Chongqing) with the administrative status of provinces, as well as two mainly self-governing Special Administrative Regions (SARs, Hong Kong and Macau). According to article 95 of the Chinese Constitution (of 1982 as amended in 2004), at all of these administrative levels, "people's congresses and people's governments are established". However, the central government exercises full jurisdiction over all of these levels. There is – apart from the Special Administrative Regions – no right to local self-government provided for in the Chinese Constitution.

Nevertheless, due to the economic reform and immensely rapid urbanization that China has been undergoing in recent decades, decentralized governance structures were significantly strengthened (Liu & Salzberg, 2012). Although the central government reviews and approves urban master plans for major cities, big investment projects and rural-to-urban land conversion, municipal governments are primarily responsible for urban development (Liu & Salzberg, 2012). The scope for action of local governments in China is in a way much wider than in Germany, considering that their responsibility encompasses the local economy, employment, and the provision of municipal services (Liu & Salzberg, 2012). The local level is also often used as a testing ground for new policies and institutional arrangements.

China's NDC, issued on 30 June 2015, is much more detailed than the EU one and explicitly refers to strengthening accountability schemes and the relevance of local action in several ways. According to its NDC, by 2030 China aims "to achieve the peaking of carbon dioxide emissions around 2030 and making best efforts to peak early; [t]o lower carbon dioxide emissions per unit of GDP by 60%–65% from the 2005

level; [t]o increase the share of non-fossil fuels in primary energy consumption to around 20%; and [t]o increase the forest stock volume by around 4.5 billion cubic meters on the 2005 level” (NDC, unofficial English translation). One of the measures to implement enhanced actions on climate change is “[t]o improve the overall administration of climate-change-related work and to make carbon-emission-related indicators play guiding role, by subdividing and implementing climate change targets and tasks, and improving the performance evaluation and accountability system on climate change and low-carbon development targets” (NDC, unofficial English translation).

In section B of its NDC, China explicitly refers to policies and measures relating to urban areas. It formulates different strategies for different types of “development-planning zones”. Accordingly, China aims to “strictly control” GHG emissions in Urbanized Zones for Optimized Development, to “enhance carbon intensity control” in Urbanized Zones for Focused Development, and to “accelerate green and low-carbon transformation in old industrial bases and resource-based cities”. Furthermore, in Key Ecological Zones, development of new carbon intensive projects shall be constrained, and “ecological red lines” defined.

Low-carbon urban development is addressed in other sections of China's NDC as well. China aims to, among others, “integrat[e] the low-carbon development concept in the entire process of urban planning, construction and management”, “promote the share of green buildings in newly built buildings of cities and towns reaching 50% by 2020”, “promote the share of public transport in motorized travel in big-and-medium-sized cities reaching 30% by 2020” (section B on buildings and transport). Furthermore, China intends to “promote a low-carbon way of life” (section G), “advance low-carbon pilots in provinces and cities”, and “conduct low-carbon cities (towns) pilots” (section I on innovation). China also dedicates a whole section of its NDC to “improving statistical and accounting system for GHG emissions” (section M). Among the measures planned in this regard are the preparation of “[GHG] inventories at the national and provincial level on a regular basis” and building “a fundamental statistics and accounting system for [GHG] emissions at national, subnational and enterprise levels”.

The multi-level climate governance system of China follows a strict top-down approach (Wu, Tang, & Wang, 2016). The central government formulates the emission reduction policy and respective administrative regulations. The 12th Five-Year Plan for the first time set a binding target of 17% reduction in CO₂ emissions per unit of GDP from 2011 to 2015 (Khanna, Fridley, & Hong, 2014 citing the National People's Congress 2011). Among the current key documents steering Chinese climate change mitigation action at the national level are the 13th Five-Year Plan (2016–2020) and the National Programme on Climate Change (2014–2020). Specific targets are divided between the different provinces, and provincial governments are responsible for reaching these goals at their level via provincial climate programmes. Provinces again divide up responsibilities and hand them down, via prefectural and county-level governments, to city levels. Provincial and local governments subdivide specific targets at a horizontal level among provincial industries and local authorities. Each lower level signs a “Letter of Responsibility” that defines its share of responsibility towards the next higher level of governance (Wu et al., 2016). All along the hierarchy chain, depending on whether a target is reached or not, there will be a reward or a form of negative consequence, for example, in terms of further promotion within the cadre (Wu et al., 2016; Khanna et al., 2014).

In 2010 and 2012, the National Development and Reform Commission (NDRC), China's principal planning agency for national economic and social development, initiated in two executive orders a low-carbon pilot province and city programme that identified a total of 42 low-carbon pilots (iGDP, 2015; Khanna et al., 2014). The programme does not provide for a definition of a low-carbon city or any quantitative emission reduction goals to be reached. However, it requires each participating pilot to formulate a low-carbon development

plan and supporting policies, develop low-carbon industry, CO₂ emission statistics and data management systems, and encourage low-carbon lifestyle and consumption (Khanna et al., 2014, 112). In its report “China's Policies and Actions on Climate Change 2015”, the NDRC highlights several activities of low-carbon city pilots, including strengthening the peak-target-forced mechanism, improving the GHG emission statistics and management system, and establishing a target-oriented responsibility system to achieve GHG emission control targets (NDRC, 2015, 31f.). Accordingly, out of a total of 42 pilot provinces and cities, including Beijing, Shanghai, Hainan Province and Shijiazhuang in Hebei Province, 13 established low-carbon development funds, and 36 set up carbon reduction targets and assessment mechanisms (NDRC, 2015, 32). Among the specific measures applied in pilot cities are, for example, an urban carbon emission accounting and management platform, carbon emission impact assessment, and carbon emission trading (NDRC, 2015). Khanna et al. (2014) provide a comprehensive overview of city-focused eco- and low-carbon national programmes in China and a comparative ex-ante assessment of the low-carbon development plans, targets and supporting measures that have been enacted by China's first eight pilot low-carbon cities, including Tianjin, Baoding, Xiamen and Shenzhen. Wang, Engels, and Wang (2017) concisely summarize the current state of research on the role of cities in China's transition to low-carbon development. The strategic low-carbon urban governance of the city of Shenzhen will be explored below.

4.3. Hamburg

Hamburg is located in the north of Germany on the river Elbe. With 1.7 million inhabitants, it is the second largest city in Germany and the eighth largest city in the European Union. Its metropolitan region accounts for more than five million inhabitants. Hamburg has the second largest port in Europe and is known as a media centre. Other major employers belong to the aircraft, shipping and chemical industries. Hamburg is one of the three city-states in Germany which gives it significantly wider legislative scope of influence compared to municipalities. It has the highest per capita GDP in Germany and its density is 2409 inhabitants per km². Its current per capita carbon emissions are 10.2 tonnes CO₂/year (climate plan, p. 7). Hamburg has been a member of the German Climate Alliance (Klimabündnis) since 1993 and of the Covenant of Mayors for Climate and Energy since 2008. It reports its GHG emission data to the CDP (formerly Carbon Disclosure Project) annually.

The Hamburg case study provides valuable insights into innovative strategic urban governance, especially with a view to the monitoring and assessment of urban climate change mitigation action. In December 2015, the State Parliament of Hamburg adopted its most recent climate plan (Hamburger Klimaplan, Drs. 21/2521) which envisages Hamburg becoming a “climate smart city”. It aims to halve GHG emissions by 2030 and reach a GHG emission reduction of at least 80% by 2050 compared to 1990 levels. In addition, Hamburg maintains a quantitative target of a reduction in CO₂ emissions of almost 2 million tonnes by 2020. Furthermore, the climate plan sets quantitative goals for reduced carbon emissions per capita: 9 t CO₂ per capita by 2020, 6 t by 2030 and 2 t by 2050 (Hamburger Klimaplan, p. 7). The city created a central body responsible for coordinating and steering action on climate change mitigation and adaptation between Hamburg State authorities: the Hamburg Coordination Centre for Climate Issues (Leitstelle Klimaschutz) (Hamburger Klimaplan p. 8; Engels, Wickel, Knieling, Kretschmann, & Walz, 2018).

The long-term goals are envisaged to be achieved through a transformative process divided into a number of so-called adaptive management cycles (Hamburger Klimaplan p. 10). Thematically, the transformation process builds on four aggregated strategic clusters and formulates cluster-specific goals: the transformation of urban spaces, the green economy, the city as a role model, and climate communication (Hamburger Klimaplan p. 11). For example, a sub-goal of the

cluster “the city as a role model” is that the Hamburg state administration becomes climate neutral by 2030 (Hamburger Klimaplan p. 15). In the field of energy infrastructure, Hamburg gained comparably bigger influence since a referendum vote for the repurchase of all energy grids (gas, electricity, heat supply; Hamburger Klimaplan p. 25f.). The climate plan specifies 14 areas of activity, such as – inter alia – energy, buildings, transport, resource consumption, nature conservation and health, with specific indicators (only partly developed so far), exemplary measures and pilot projects.

A special strength in Hamburg's climate mitigation action is the effort made in respect of assessment. The Hamburg climate plan dedicates a whole chapter to control and monitoring (Hamburger Klimaplan, chapter V, p. 67f). The Hamburg Coordination Centre for Climate Issues is responsible for the controlling of measures and financial flows as well as CO₂ monitoring. It developed an intranet procedure which requests yearly information on measures, finances and CO₂ reductions (Hamburger Klimaplan p. 67). Annex 1 to the Hamburg climate plan lists, divided into the 14 areas of activity, 175 specific measures and the associated annual financial expenditure; Annex 2 sets out the measure-specific reduction target for the year 2020 and the annual reductions achieved in 2013 and 2014. This project-focused “bottom-up” method (Hamburger Klimaplan p. 73f.) has been developed through close cooperation between the city of Hamburg and the Wuppertal Institute for Climate, Ecology and Energy and has been first successfully applied in a predecessor of the climate plan from 2007 to 2012 (Hamburger Klimaschutzkonzept). It aims to enable a measure-specific assessment of carbon mitigation action in order to reliably inform future decision-making based on the quantifiable failure or success of such specific measures. In parallel, a “top-down” inventory is also provided for (Hamburger Klimaplan p. 77).

The interim results of the monitoring process show, for the year 2013, an overall CO₂ emission reduction of 14.3% compared to the base year 1990, per capita emission reduction of 13.5% compared to the base year 2003, as well as a GHG-intensity reduction per unit of GDP of 28.4% compared to the 2003 level (Hamburger Klimaplan p. 78).

4.4. Shenzhen

Shenzhen is located in the Guangdong province on the eastern coast of the Pearl River Delta in the south of China just north of Hong Kong. In 2015, its population amounted to 10.77 million inhabitants. Shenzhen is the first Special Economic Zone established by China in 1980 in the process of its economic opening and has undergone enormous industrialization, urbanization and economic growth in recent decades. It has sub-provincial administrative status, with slightly less powers than a province. Its local economy is characterized by a strong financial sector and one of the busiest container ports in the world. In 2015, Shenzhen had a per capita GDP of 25,038 USD. Its population density is 5398 inhabitants per km², which makes it the city with the highest density in China. Its per capita GHG emissions in 2010 were 6.5 tonnes/year. Shenzhen is a member of C40 Cities; it reports to the carbon Climate Registry and to CDP.

Shenzhen provides an interesting case study with regard to institutional innovation in urban climate change mitigation action because it is among the first 13 Chinese pilot low-carbon cities and, at the same time, one of the seven carbon emission trading pilot areas. In 2016, it won the C40 award for Best Finance & Economic Development Project for its Emissions Trading System. As the key document guiding the low-carbon transition of Shenzhen in line with central government's 12th and 13th Five-Year Plans, the city formulated a long-term low-carbon development plan (2011–2020) (Wu et al., 2016). It sets a range of major goals divided into the categories of low-carbon output, low-carbon resources, and low-carbon environment (Wu et al., 2016; Khanna et al., 2014). For example, it targets a reduction rate in carbon intensity of 39% by 2015 and 45% by 2020. In absolute numbers it aims for a carbon intensity of 0.90 (2015) and 0.81 (2020) tons of CO₂/

10,000 yuan. Other targets are the proportion of green buildings among new buildings of 40% (2015) and 80% (2020), the public transport share of motorized travel of 56% (2015) and 65% (2020) and specific units of new energy car ownership of 50,000 units in 2015 and 100,000 units in 2020. Examples of targets within the category of low-carbon resources are a proportion of clean energy in energy consumption of 50% in 2015 and 60% in 2020 and a park green land area of 16.9 (2015) and 17.4 (2020) m²/person. In the category of low-carbon environment Shenzhen's target is to have a “basically built” system of carbon emissions statistics, calculation and evaluation by 2015 and to further develop it to be “more perfect” by 2020. Interestingly, another goal of this category is to have 80% of citizens familiar with the concept of low-carbon by 2015 and 90% by 2020.

As a steering body, Shenzhen formed a climate governance group corresponding to the leading institutions at the central government level (Wu et al., 2016). Shenzhen's statistical yearbook shows that it accomplished a number of goals set by the 12th Five-Year Plan (Wu et al., 2016). Among specific measures are, for example, an upgrading of the industrial structure from high-energy consumption enterprises to low-carbon enterprises, cleaner energy production by promotion of natural gas imported from Australia, PV power generation, biomass energy, compulsory installation of solar heating systems in buildings of less than 12 floors, and establishment of the first carbon market with the mandatory participation of 635 enterprises and 197 large public buildings (Wu et al., 2016).

In order to ensure proper implementation of the local targets and policies, Shenzhen established a strict top-down mechanism to evaluate the performance of the local government via the Environmental Protection Performance Evaluation Regulation (Wu et al., 2016). The leading groups in the party committees and in the government are responsible for the implementation of the mechanism. The primary principals in charge are those of the respective divisions, departments, and districts. The results of the evaluation feed into the assessment of political achievement, which is decisive for annual appraisals and the selection of leading cadres (Wu et al., 2016).

4.5. Emerging patterns of accountability

Applying the accountability analysis as developed above to the two case studies, varying patterns of accountability become visible in institutional arrangements in both the vertical and the horizontal perspective.

Vertical responsibility differs greatly between German and Chinese cities. German cities do not play any significant quantifiable role in German national action on climate change mitigation as laid out in the German CAP. By contrast, China's top-down climate policy approach, which sets and breaks down CO₂ emission reduction targets through all levels of government down to city level formally fixed in “Letters of Responsibility” and backed up by a bottom-up obligation to report actual performance, institutes comparatively “hard” vertical responsibility chains. Specific requirements of vertical responsibility become more ambitious if a Chinese city, like Shenzhen, is one of the low-carbon pilot cities. In Germany, the vertical responsibility of cities arises when a city voluntarily participates in one of the funding programmes of the National Climate Initiative. Depending on the programme, the flow of funds goes along with signing up to ambitious quantitative GHG emission reduction goals and reporting requirements. From a horizontal perspective, cities in Germany and China may voluntarily become members of city networks such as C40 Cities and the Covenant of Mayors for Climate and Energy and partner with external co-operators or funding organizations in specific projects. Depending on the conditions of the voluntarily chosen horizontal programme, cities enter into horizontal commitments usually in terms of reporting requirements.

Transparency and assessment of city-level action on climate change mitigation are not required in vertical governance in Germany except

for those cities that participate in funding programmes. Nevertheless, many German cities voluntarily publish their climate mitigation plans and assess their achievements. Respective evaluation results are usually publicly available as well. However, the exact data, its sources, and the methodologies applied in reaching the numbers in the evaluation often remain unclear. This is partly due to very complex assessment, the actual lack of local data which forces assessors to use aggregated data and build on assumptions and estimates, and also due to a variety of methodologies applied in different cities.

Both cities, Hamburg and Shenzhen, created institutions responsible for coordinating and monitoring the implementation of their respective climate change mitigation and low-carbon development plans. Hamburg put special emphasis on developing a comparatively strong monitoring and assessment procedure focused on 175 specified emission reduction measures. Chinese cities are obliged to assess and report on their low-carbon development activities to the next higher level in the climate governance hierarchy. However, the author was unable to discover whether evaluation reports are regularly made publicly available. Targets in Shenzhen's low-carbon development plan as well as current research suggest that urban GHG inventories and the assessment of cities' measures are still under development. Horizontally, some German and Chinese cities voluntarily report to international databases such as the CDP and the carbonn Climate Registry. Several Chinese cities participated as pilots in applying the method of the 'Global Protocol for Community-Scale GHG Emission Inventories' (GHG Protocol).

The Hamburg climate plan has been developed by the Hamburg state senate. Since a climate plan is an informal planning instrument, there are no procedural, including participatory, requirements set out by German law. Every German city is free to choose an appropriate procedure and to develop and enact its own climate change mitigation plan. The Hamburg climate plan has been critically discussed by various stakeholders, including the Hamburg "Zukunftsrat", a local NGO concerned with global and local sustainable development.

Chinese cities also seem to be free to choose the format and procedure used to enact their local low-carbon development plans. In Shenzhen, public satisfaction is one component of the local performance evaluation system. Public opinion has to be investigated via surveys; the statistical department of the city is responsible for implementation (Wu et al., 2016). Thus cities in Germany or China are neither, vertically nor horizontally, required to adopt nor are limited to certain forms of participation when they enact local climate mitigation and low-carbon development plans.

5. Conclusions and outlook

The study showed that factual responsibilities as well as vertical and – depending on membership – horizontal political mandates require institutional innovation for enhanced and accountable climate change mitigation action at city level. Drawing on political documents, scientific literature and institutional arrangements under the international climate regime, four components of an institutional accountability analysis have been identified: responsibility, transparency, assessment, and participation. A search for these components in vertical and horizontal institutional settings as well as the internal strategic steering of action on climate change mitigation in Chinese and German cities identified very different but overall emerging patterns of accountability. However, the research also shows gaps in institutional accountability that need to be filled if cities are to become a reliable contributor in polycentric climate change mitigation efforts. Further comparative institutional analyses might prove fruitful in enabling an exchange of experiences and developing improved accountability mechanisms.

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